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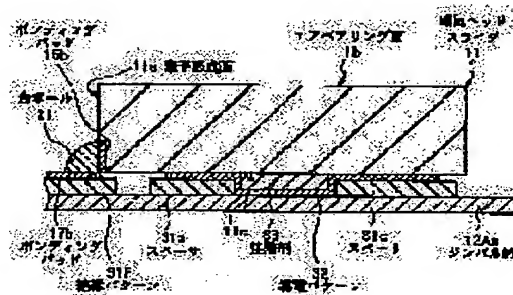
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## (54) HEAD SLIDER SUPPORT AND HEAD DEVICE AND THEIR MANUFACTURING METHOD

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To simplify manufacturing processes, to improve workability and durability and to prevent the occurrence of a dielectric breakdown of a head element in a magnetic disk device.

**SOLUTION:** A gimbal section 12Aa, which supports a magnetic head slider 11, makes up a portion of the flexure in the suspension of a magnetic head device. Insulating spacers 31a, 31b, 31c, 31d and 31e are formed on the section 12Aa and an electrically conductive pattern 32 is formed to electrically connect the top surfaces of the spacers 31a to 31e and the surface of the section 12Aa. The slider 11 is adhered by adhesive 33 on the section 12Aa and fixed. Regardless of the conductivity of the adhesive 33, a grounding electrode of a back surface 11c of the slider 11 is surely grounded and connected through the pattern 32 and the flexure.



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**CLAIMS**

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[Claim(s)]

[Claim 1] The head slider base material characterized by having the slider supporter material as a base material which supports the head slider which has a head component, and the electric conduction pattern which maintains a head slider at touch-down potential when it is formed so that it may extend on said slider supporter material at least, and said head slider is carried.

[Claim 2] Said electric conduction pattern is a head slider base material according to claim 1 characterized by being formed of the same ingredient and same process as a circuit pattern for transmitting the I/O signal over said head component.

[Claim 3] Said electric conduction pattern is a head slider base material according to claim 1 or 2 characterized by including much more conductive thin film at least.

[Claim 4] Said conductive thin film is a head slider base material according to claim 3 characterized by consisting of a metal.

[Claim 5] Said metal is a head slider base material according to claim 4 characterized by including either [ at least ] copper or gold.

[Claim 6] Furthermore, the head slider base material according to claim 1 characterized by having the insulating spacer which secures the space for adhesives restoration between a head slider and slider supporter material when it is formed alternatively and said head slider is carried on the front face of said slider supporter material.

[Claim 7] Said slider supporter material is a head slider base material according to claim 6 characterized by maintaining the front face at touch-down potential at least.

[Claim 8] Said electric conduction pattern is a head slider base material according to claim 7 characterized by being formed so that the field applied to the front face of said slider supporter material from the top face of said spacer may be covered continuously.

[Claim 9] Said electric conduction pattern is claim 6 characterized by being formed of the same ingredient and same process as a circuit pattern for transmitting the I/O signal over said head component thru/or a head slider base material given in any 1 of 8.

[Claim 10] Said electric conduction pattern is claim 6 characterized by including much more conductive thin film at least thru/or a head slider base material given in any 1 of 9.

[Claim 11] Said conductive thin film is a head slider base material according to claim 10 characterized by consisting of a metal.

[Claim 12] Said metal is a head slider base material according to claim 11 characterized by including either [ at least ] copper or gold.

[Claim 13] Said spacer is claim 6 characterized by being formed of the same ingredient and same process as the insulating pattern prepared in order to insulate the circuit pattern for transmitting the I/O signal over said head component from said slider supporter material thru/or a head slider base material given in any 1 of 12.

[Claim 14] Said spacer is claim 6 characterized by being formed as a pattern divided into two or more parts thru/or a head slider base material given in any 1 of 13.

[Claim 15] Said spacer is claim 6 characterized by consisting of insulating resin thru/or a head slider base material given in any 1 of 14.

[Claim 16] Said insulating resin is a head slider base material according to claim 15 characterized

by being polyimide.

[Claim 17] Head equipment characterized by having the electric conduction pattern which maintains said head slider at touch-down potential while being formed so that it may extend on said slider supporter material at least with the head slider which has a head component, and the slider supporter material as a base material which supports said head slider.

[Claim 18] Said electric conduction pattern is head equipment according to claim 17 characterized by being formed of the same ingredient and same process as a circuit pattern for transmitting the I/O signal over said head component.

[Claim 19] Said electric conduction pattern is head equipment according to claim 17 or 18 characterized by including much more conductive thin film at least.

[Claim 20] Said conductive thin film is head equipment according to claim 19 characterized by consisting of a metal.

[Claim 21] Said metal is head equipment according to claim 20 characterized by including either [ at least ] copper or gold.

[Claim 22] Furthermore, head equipment according to claim 17 characterized by having the insulating spacer which is alternatively formed on the front face of said slider supporter material, and secures the space for adhesives restoration between said head slider and slider supporter material.

[Claim 23] Said slider supporter material is head equipment according to claim 22 characterized by maintaining the front face at touch-down potential at least.

[Claim 24] Said electric conduction pattern is head equipment according to claim 23 characterized by being formed so that the field applied to the front face of said slider supporter material from the top face of said spacer may be covered continuously.

[Claim 25] Said electric conduction pattern is claim 22 characterized by being formed of the same ingredient and same process as a circuit pattern for transmitting the I/O signal over said head component thru/or head equipment given in any 1 of 24.

[Claim 26] Said electric conduction pattern is claim 22 characterized by including much more conductive thin film at least thru/or head equipment given in any 1 of 25.

[Claim 27] Said conductive thin film is head equipment according to claim 26 characterized by consisting of a metal.

[Claim 28] Said metal is head equipment according to claim 27 characterized by including either [ at least ] copper or gold.

[Claim 29] Said head slider is claim 22 characterized by having fixed to said slider supporter material with the adhesives with which the space for said adhesives restoration was filled up thru/or head equipment given in any 1 of 28.

[Claim 30] Said adhesives are head equipment according to claim 29 characterized by being what has conductivity.

[Claim 31] Said adhesives are head equipment according to claim 30 characterized by consisting of resin which contains silver at least.

[Claim 32] Said spacer is claim 22 characterized by being formed of the same ingredient and same process as the insulating pattern prepared in order to insulate the circuit pattern for transmitting the I/O signal over said head component from said slider supporter material thru/or head equipment given in any 1 of 31.

[Claim 33] Said spacer is head equipment given in any 1 of claim 22 characterized by being formed as a pattern divided into two or more parts thru/or claims 32.

[Claim 34] Said spacer is head equipment given in any 1 of claim 22 characterized by consisting of insulating resin thru/or claims 33.

[Claim 35] Said insulating resin is head equipment according to claim 34 characterized by being polyimide.

[Claim 36] The manufacture approach of the head slider base material characterized by including the process which forms the slider supporter material as a base material which supports the head slider which has a head component, and the process which forms the electric conduction pattern which maintains a head slider at touch-down potential at least when said head slider is carried on said slider supporter material.

[Claim 37] Furthermore, when said head slider is alternatively carried on the front face of said slider supporter material, while including the process which forms the insulating spacer which secures the space for adhesives restoration between a head slider and slider supporter material Said slider supporter material is formed so that a front face may be maintained at touch-down potential at least. The manufacture approach of the head slider base material according to claim 36 characterized by forming so that the field which covers said electric conduction pattern over the front face of said slider supporter material from the top face of said spacer may be covered continuously.

[Claim 38] The manufacture approach of the head slider base material according to claim 37 characterized by making it form according to the same ingredient and same process as the insulating pattern prepared in order to insulate the circuit pattern for transmitting an I/O signal [ as opposed to said head component for said spacer ] from said slider supporter material.

[Claim 39] The manufacture approach of claim 36 characterized by making it form according to the same ingredient and same process as a circuit pattern for transmitting an I/O signal [ as opposed to said head component for said electric conduction pattern ] thru/or a head slider base material given in any 1 of 38.

[Claim 40] The manufacture approach of the head equipment characterized by including the process which manufactures the head slider which has a head component, the process which manufactures the slider supporter material as a base material which supports said head slider, and the process which forms the electric conduction pattern for maintaining said head slider at touch-down potential on said slider supporter material at least.

[Claim 41] Furthermore, the process which forms the insulating spacer for securing the space for adhesives restoration between said head slider and slider supporter material alternatively on the front face of said slider supporter material, While including the process which fixes said head slider to said slider supporter material with the adhesives filled up by the space for said adhesives restoration The manufacture approach of the head equipment according to claim 40 characterized by forming said slider supporter material so that a front face may be maintained at touch-down potential at least, and forming so that the field which covers said electric conduction pattern over the front face of said slider supporter material from the top face of said spacer may be covered continuously.

[Claim 42] The manufacture approach of the head equipment according to claim 41 characterized by making it form according to the same ingredient and same process as the insulating pattern prepared in order to insulate the circuit pattern for transmitting an I/O signal [ as opposed to said head component for said spacer ] from said slider supporter material.

[Claim 43] The manufacture approach of claim 40 characterized by making it form according to the same ingredient and same process as a circuit pattern for transmitting an I/O signal [ as opposed to said head component for said electric conduction pattern ] thru/or head equipment given in any 1 of 42.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the head equipments which come to carry a head slider in the slider base material used since the head slider which has either [ at least ] a head component for magnetic recording or a head component for magnetic reproducing is carried, and such a slider base material, and those manufacture approaches in information record regenerative apparatus, such as a magnetic disk drive and optical-magnetic disc equipment.

[0002]

[Description of the Prior Art] Generally, head equipment has the configuration which supports the head slider with which the head component was formed with a slider base material (henceforth a suspension). And after only the fixed amount has surfaced the head slider from the front face of a magnetic-recording medium by this suspension, playback of the information from record media, such as a magnetic disk, or informational record is performed.

[0003] Conventionally, such head equipment of a surfacing mold is assembled by connecting the bonding pad which is a signal connection by the side of a head slider, and the bonding pad which is a signal connection by the side of a suspension by the ball bonding using gold (Au) etc. while pasting up a head slider with resin adhesives on a suspension.

[0004] By the way, with this kind of head equipment, it may originate in the flying height of a head slider being very small etc. to sliding between the surfacing side of a head slider, and a disk front face, and the front face of a disk which carries out high-speed rotation at the time of actual use, and static electricity may occur. However, since the head component is formed of the thin film technology, it is usually easy to be destroyed by static electricity generated at the time of such use. Between a head slider and suspensions was electrically connected by ball bonding using the solder contact pad, and the cure which misses static electricity produced in the head slider to touch-down through a suspension was made in order to prevent this beforehand, for example, as indicated by JP,63-113917,A. Moreover, as other approaches, after pasting up a head slider and a suspension, applying conductive resin between the back end surface part of a head slider and a suspension from an outside, and connecting a head slider and a suspension electrically was also performed.

[0005] In addition, as a thing relevant to this invention, to JP,63-226999,A, thermal melting arrival of the anisotropy electric conduction sheet is carried out at the insulating-substrate top in which the electrode terminal was formed, and the flexible shield wire board of a configuration of having made it connect with the terminal by the side of an insulating substrate electrically is indicated. Moreover, the technique on which a head and a suspension are pasted up using the film-like anisotropy electric conduction film (sheet) is indicated by JP,9-115125,A.

[0006] Moreover, this invention persons have proposed the head slider support device in which the partition pattern for making it two or more kinds of adhesives used for adhesion with a head slider and a suspension not contact mutually was formed, in JP,9-282824,A as a thing relevant to this invention.

[0007]

[Problem(s) to be Solved by the Invention] By the approach of connecting a head slider and a

suspension by ball bonding among the techniques enumerated above using a solder contact pad, if the pressure beyond a convention joins a pad in a ball bonding process, a suspension will deform. Consequently, the surfacing property of a head slider is affected and un-arranging [ that the yield falls ] arises. Moreover, the spreading process of conductive resin other than the adhesion process of a head slider and a suspension is required of the approach of applying conductive resin. Therefore, since lead time increases and it is moreover manufactured through many processes as mentioned above, the static electricity destruction of a head component may take place at the time of handling.

[0008] On the other hand, if the anisotropy electric conduction sheet currently indicated by JP,63-226999,A described above, for example is applied to the approach indicated by JP,9-115125,A, it will be thought that the ball bonding process as a cure against static electricity etc. becomes unnecessary. However, since a head slider is about [ 1.0mmx1.2mm ] minute magnitude, it is very difficult the slider in the present condition to connect a head slider to a suspension through an anisotropy electric conduction sheet. Moreover, in case the anisotropy electric conduction film is stuck and a head and a suspension are connected, a highly precise alignment technique is required of the approach using the anisotropy electric conduction film of the shape of such a film. Moreover, two processes, temporary adhesion and this adhesion, are required of this approach, and since a production process increases, compaction of a manufacturing lead time is difficult.

[0009] Then, this invention persons have proposed the approach of connecting both electrically at the same time they fix a head slider to a suspension using anisotropy electric conduction adhesives etc., as it is in Japanese Patent Application No. No. 347678 [ nine to ]. According to this approach, since reservation of the flow between both head slider, and both [ adhesion and ] is realizable with one process, compaction of a manufacturing lead time is possible.

[0010] However, by this approach, it cannot declare that it is not necessarily easy to attain effective electrostatic-discharge prevention, securing good workability and sufficient bond strength the following point. It originates in trying to constitute anisotropy electric conduction adhesives by scouring conductive ingredients, such as silver dust, to the insulating resin for adhesion. That is, if the content of the conductive ingredient in anisotropy electric conduction adhesives is made to increase, while the viscosity as adhesives will become large and workability will get worse, adhesive strength declines, improvement in endurance becomes difficult, on the other hand, if the content of the conductive ingredient in anisotropy electric conduction adhesives is lessened, conductivity will fall (resistance increases) and sufficient flow between a head slider and a suspension will not be obtained.

[0011] This invention was made in view of this trouble, and the purpose is in offering the head slider base material which enables effective prevention of the electrostatic discharge of a head component, head equipments, and these manufacture approaches, realizing simplification of a production process, improvement of workability, and improvement in endurance.

[0012]

[Means for Solving the Problem] The head slider base material of this invention is equipped with the slider supporter material as a base material which supports the head slider which has a head component, and the electric conduction pattern which maintains a head slider at touch-down potential when it is formed so that it may extend on slider supporter material, and a head slider is carried.

[0013] In the head slider base material of this invention, when a head slider is carried on slider supporter material, a head slider is maintained at touch-down potential by the electric conduction pattern formed so that it might extend on slider supporter material.

[0014] Moreover, when it is formed alternatively and a head slider is further carried on the front face of slider supporter material, you may make it have the insulating spacer which secures the space for adhesives restoration between a head slider and slider supporter material in the head slider base material of this invention. In this case, a front face is maintained at touch-down potential, and you may make it form an electric conduction pattern further, at least, so that the field of slider supporter material applied to the front face of slider supporter material from the top face of a spacer may be covered continuously. Here, a spacer can be formed also as a

pattern divided into two or more parts.

[0015] The head equipment of this invention is equipped with the electric conduction pattern which maintains a head slider at touch-down potential while it is formed so that it may extend on the head slider which has a head component, the slider supporter material as a base material which supports a head slider, and slider supporter material. With the head equipment of this invention, a head slider is maintained at touch-down potential by the electric conduction pattern formed so that it might extend on slider supporter material.

[0016] It is further formed alternatively on the front face of slider supporter material, and you may make it have the insulating spacer which secures the space for adhesives restoration between a head slider and slider supporter material with the head equipment of this invention. In this case, even if there is little slider supporter material, you may make it maintain a front face at touch-down potential. Furthermore, an electric conduction pattern may be formed so that the field applied to the front face of slider supporter material from the top face of a spacer may be covered continuously. And you may make it a head slider fix to slider supporter material with the adhesives with which the space for adhesives restoration was filled up. Here, a spacer can be formed also as a pattern divided into two or more parts. Moreover, the resin with which it is suitable having conductivity with resin, for example, it contains silver at least can constitute adhesives.

[0017] Moreover, with the head slider base material or head equipment of this invention, an electric conduction pattern may be made to be formed of the same ingredient and same process as a circuit pattern for transmitting the I/O signal over a head component.

[0018] Moreover, with the head slider base material or head equipment of this invention, a spacer may be made to be formed of the same ingredient and same process as the insulating pattern prepared in order to insulate the circuit pattern for transmitting the I/O signal over a head component from slider supporter material.

[0019] Moreover, things are [ making it be that in which an electric conduction pattern contains much more conductive thin film at least with the head slider base material or head equipment of this invention ] possible. Here, what can form with a metal and contains either [ at least ] copper or gold as this metal is suitable for a conductive thin film.

[0020] Moreover, it is possible to constitute from the head slider base material or head equipment of this invention so that it may be what a spacer becomes from insulating resin. As insulating resin, it is suitable to use polyimide, for example.

[0021] The manufacture approach of the head slider base material concerning this invention includes the process which forms the slider supporter material as a base material which supports the head slider which has a head component, and the process which forms the electric conduction pattern which maintains a head slider at touch-down potential when a head slider is carried on slider supporter material.

[0022] The manufacture approach of the head equipment concerning this invention includes the process which manufactures the head slider which has a head component, the process which manufactures the slider supporter material as a base material which supports a head slider, and the process which forms the electric conduction pattern for maintaining a head slider at touch-down potential on slider supporter material.

[0023]

[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained to a detail with reference to a drawing.

[0024] [Head equipment concerning gestalt of operation of this invention] drawing 5 expresses the appearance configuration of the magnetic disk drive with which the head equipment concerning the gestalt of 1 operation of this invention is applied. This magnetic disk drive is equipped with the magnetic-head slider (it is only hereafter described also as the magnetic head or a head.) 11 with which it comes to form the head core section on a base, and the magnetic disk (it is only hereafter described also as a disk.) 110 as a record medium. A magnetic disk 110 rotates with a spindle motor 111. An end side is supported by the point by the side of the other end of the suspension 12 attached in the drive arm 131, and the magnetic-head slider 11 counters the front face of a magnetic disk 110, and is arranged. The drive arm 131 consists of



dies casting which used aluminum.

[0025] This magnetic disk drive equips the base side of the drive arm 131 with the carriage section 120 for positioning the magnetic-head slider 11 on the track of a magnetic disk 110 again. The carriage section 120 is constituted including a revolving shaft 121, the carriage 122 in which the revolving shaft 121 was formed rotatable as a core, and the actuator 123 which consists of a voice coil motor etc. An actuator 123 drives carriage 122 so that a revolving shaft 121 may be rotated as a core, and thereby, the magnetic-head slider 11 is movable radial [ of a magnetic disk 110 ]. Here, the magnetic-head slider 11 and the suspension 12 constitute a part for the principal part of the head equipment concerning this invention.

[0026] In addition, although only one magnetic-head equipment 10 is illustrated and others are omitted in drawing 5, magnetic-head equipment is formed one [ at a time ] for every field of two or more magnetic disks 110 in fact.

[0027] Drawing 1 thru/or drawing 4 express the important section of the head equipment concerning the gestalt of 1 operation of this invention, and, specifically, expresses the configuration of a part of magnetic-head slider 11 shown in drawing 5, and suspension 12. In addition, since it is embodied by the head equipment concerning the gestalt of this operation, it combines below and the head slider base material concerning the gestalt of operation of this invention is explained. Here, drawing 1 expresses the condition of having looked down at the important section from the slanting upper part, when record-medium opposed face (henceforth air bearing side) 11b of the magnetic-head slider 11 is turned upwards and magnetic-head equipment has been arranged. Drawing 2 expresses the cross-section configuration of the direction of an II-II line view of drawing 1, and drawing 3 expresses the planar structure seen from the top. Moreover, drawing 4 expresses the cross-section configuration of the direction of an IV-IV line view in drawing 3. In addition, illustration of the magnetic-head slider 11 is omitted and the imaginary line (two-dot chain line) expresses the helicopter loading site in drawing 3.

[0028] As shown in drawing 1 and drawing 2, this magnetic-head equipment 10 is equipped with the magnetic-head slider 11 and the suspension 12 for supporting the magnetic-head slider 11. The suspension 12 is constituted including FUREKU shear 12A as an elastic support object, and load beam 12B as a rigid base material. Here, the magnetic-head slider 11 is equivalent to the "head slider" in this invention, and a suspension 12 corresponds to the "slider supporter material" in this invention.

[0029] As shown in drawing 1, the magnetic-head slider 11 has the configuration of a rectangular parallelepiped mostly, and the magnetic-head component 14 and the bonding pads 15a-15d for signal I/O are formed in component forming face 11a which is the side edge side of one of these, respectively. The magnetic-head component 14 includes the induction type MAG sensing element for writing, the magnetic resistance element for read-out (MR (Magneto Resistive) component), or its both sides. Here, the magnetic-head component 14 is equivalent to the "head component" in this invention.

[0030] It is fixed to a part for the point of load beam 12B, and FUREKU shear 12A which constitutes a part of suspension 12 carries out gimbal actuation to the magnetic-head slider 11 and one while being formed with a thin stainless steel plate with a thickness of about 25 micrometers. On FUREKU shear 12A, four lead patterns 16a-16d as an I/O signal line are mostly formed over the overall length through insulating pattern 31f ( drawing 3 and drawing 4 ). In addition, illustration of insulating pattern 31f is omitted in drawing 1 and drawing 2. Here, the lead patterns 16a-16d are equivalent to the "circuit pattern" in this invention, and insulating pattern 31f corresponds to the "insulating pattern" in this invention.

[0031] The lead patterns 16a-16d consist of a thin film pattern which carried out the laminating of copper (Cu), gold (Au) or copper, and the gold, and each end section is connected to four bonding pads 17a-17d formed on FUREKU shear 12A, respectively. Each lead patterns [ 16a-16d ] other end is connected to the connection terminal (not shown) by the thin film pattern for connecting with an external circuit. Bonding pads 17a-17d are electrically connected to the bonding pads 15a-15d by the side of the magnetic-head slider 11 by the golden ball 21 grade, for example, respectively. In addition, illustration of the golden ball 21 is omitted in drawing 1.

[0032] Load beam 12B is formed with the about 62-76-micrometer thick stainless steel plate.

FUREKU shear 12A has fixed to this load beam 12B in two or more spot welding points (for example, point 18) depended on laser welding etc. Near the point of load beam 12B, the convex projection (dimple) 19 for pressing tooth-back 11c of the magnetic-head slider 11 is formed. The dimple 19 contacted at the point gimbal section 12Aa of FUREKU shear 12A which tooth-back 11c of the magnetic-head slider 11 fixed, and has controlled moving in the direction (lower part of drawing) in which the magnetic-head slider 11 surfaces from a disk.

[0033] a group which becomes the field in which the magnetic-head slider 11 will be laid among the front faces of gimbal section 12Aa which makes a part of FUREKU shear 12A as shown in drawing 3 and drawing 4 from insulating resin, such as polyimide or an acrylic, -- Spacers 31a-31e form a predetermined pattern, and are formed alternatively. Spacers 31a-31e are for making it tooth-back 11c of the magnetic-head slider 11 become the top face of gimbal 12Aa, and parallel, when the magnetic-head slider 11 is laid on gimbal 12Aa of FUREKU shear 12A. Namely, although the magnetic-head slider 11 may fix to gimbal 12Aa in the condition of having inclined by the thickness of adhesives at the maximum when the magnetic-head slider 11 is directly laid on gimbal 12Aa through adhesives, without forming Spacers 31a-31e temporarily Such a thing will be avoided if the space for adhesives restoration is beforehand secured between the magnetic-head slider 11 and gimbal section 12Aa with Spacers 31a-31e as in the gestalt of this operation. It is suitable for Spacers 31a-31e to make it formed of the same insulation ingredient as insulating pattern 31f and the same process so that it may mention later, for example, and the thickness is set to about 10-20 micrometers. Here, Spacers 31a-31e are equivalent to "the insulating spacer" in this invention.

[0034] In the gestalt of this operation, both the spacers 31a and 31c have the flat-surface configuration of a convex typeface, and as each convex side faces each other, they are arranged. Moreover, both the spacers 31b and 31d have the flat-surface configuration of a long rectangle, and as they put a part for the heights of Spacers 31a and 31c from both sides, they are arranged. moreover, the field which spacer 31e has an almost circular flat-surface configuration, and was surrounded by Spacers 31a-31d -- it is mostly arranged in the center section (location specifically corresponding to the dimple 19 of load beam 12B). However, arrangement of these spacers 31a-31e is not limited to the pattern shown in drawing 3 , but can be suitably changed into it.

[0035] As shown in drawing 3 and drawing 4 , the large field applied to the front face of gimbal section 12Aa through the side face from the top face of Spacers 31a-31e is extremely covered with the small electric conduction pattern 32 of electric resistance formed alternatively. This electric conduction pattern 32 carries out the laminating of the thin film which consists of copper (Cu), and the thin film which consists of gold (Au), and is formed. However, it is good also as a configuration using other metals. On Spacers 31a-31e, the magnetic-head slider 11 is laid through the electric conduction pattern 32. This magnetic-head slider 11 has fixed to gimbal section 12Aa with the adhesives 33 with which the crevice space surrounded by Spacers 31a-31e was filled up. In this condition, tooth-back 11c of the magnetic-head slider 11 is stuck to the electric conduction pattern 32. For this reason, tooth-back 11c of the magnetic-head slider 11 is electrically connected with gimbal section 12Aa through the electric conduction pattern 32. Here, the electric conduction pattern 32 is equivalent to the "electric conduction pattern" in this invention.

[0036] As mentioned above, bonding connection of between the bonding pads 15a-15d by the side of the magnetic-head slider 11 and the bonding pads 17a-17d by the side of FUREKU shear 12A is made with the golden (Au) ball 21, respectively.

[0037] FUREKU shear 12A containing gimbal section 12Aa is electrically connected to the housing 140 of a magnetic disk drive through the drive arm 131 grade which the base showed to drawing 1 . This housing 140 is maintained at touch-down potential. For this reason, when static electricity occurs in the magnetic-head slider 11 side, static electricity flows to the housing 140 side of the disk unit grounded through the electric conduction pattern 32 and FUREKU shear 12A from tooth-back 11c of the magnetic-head slider 11.

[0038] As adhesives 33, it is desirable to use conductive adhesives. However, you may be non-conductive adhesives. It is because between tooth-back 11c of the magnetic-head slider 11 and

gimbal section 12Aa(s) connects electrically with the electric conduction pattern 32.

[0039] Although it is desirable as conductive adhesives to use the adhesives of an isotropic electric conduction resin system, the adhesives of an anisotropy electric conduction resin system may be used. Here, the adhesives of an isotropic electric conduction resin system mix sufficiently many conductive bulking agents into an adhesives layer, and conductivity is given by mutual contact of this conductive bulking agent. On the other hand, unlike the adhesives of an isotropic electric conduction resin system, the adhesives of an anisotropy electric conduction resin system make an adhesives layer thin, stopping the amount of the conductive bulking agent in an adhesives layer as much as possible. With the adhesives of this anisotropy electric conduction resin system, in the thickness direction, while it will be in switch-on by contact of conductive bulking agents, since there is no contact of conductive bulking agents not much, it will be in the condition of not flowing at a longitudinal direction (horizontal).

[0040] The thermosetting resin hardened as an ingredient of the adhesives layer of the adhesives of an isotropic electric conduction resin system with the ultraviolet-rays hardening resin hardened by UV irradiation or heating, for example, for example, an epoxy resin, is mentioned. Moreover, as a conductive bulking agent, metal-particles metallurgy group coat plastics particles, such as silver (Ag), are mentioned, for example. It is desirable to use the thing of the shape of a particle whose mean particle diameter is about 0.5–2 micrometers, or the thing of the shape of a scale whose mean particle diameter is about 5–10 micrometers as a particle of a conductive bulking agent, for example in the case of silver.

[0041] On the other hand, as an ingredient of the adhesives layer of the adhesives of an anisotropy electric conduction resin system, the thermosetting resin hardened, for example with UV irradiation and heating, for example, an epoxy resin, is mentioned. Moreover, as a conductive bulking agent, metal-particles metallurgy group coat plastics particles, such as silver (Ag), are mentioned. In the case of silver, about 10 micrometers has [ 3 micrometers and a maximum grain size ] mean particle diameter desirable [ the magnitude of the particle of a conductive bulking agent ]. The adhesives of an anisotropy electric conduction resin system with which silver dust was mixed in acrylic resin are producible by mixing silver dust, urethane acrylate, and acrylic ester. This anisotropy electric conduction resin is 2.0kg pile/cm<sup>2</sup>. Where a load is applied, it is addition quantity of light 3000 mJ/cm<sup>2</sup>. UV irradiation is performed and it hardens further by heating for example, at the temperature C of 120 degrees for 30 minutes. For example, as adhesives of an anisotropy electric conduction resin system, that by which silver dust was mixed in acrylic resin about 40 to 60% is usable.

[0042] Next, an operation of the magnetic-head equipment of the above configurations is explained.

[0043] In this magnetic disk drive 10, as it is the following, informational record and playback are performed. That is, in drawing 5 , while the magnetic disk 110 is not rotating, the magnetic-head slider 11 and magnetic disk 110 which were pressed by the suspension 12 touch. If a magnetic disk 110 is rotated, airstream will arise between the magnetic-head slider 11 and a magnetic disk 110, and lift will arise in connection with it. Thereby, the magnetic-head slider 11 separates from the front face of a magnetic disk 110, and surfaces, and it moves relatively in a magnetic-disk 110 top, holding very small spacing by the balance with lift and the thrust of a suspension 12, and record and playback of the information over a magnetic disk 110 are performed. In addition, such a record / playback approach is called the CSS (Contact-Start-Stop) method.

[0044] It originates in the flying height of the magnetic-head slider 11 being very small etc. to sliding between the air bearing side of the magnetic-head slider 11, and the front face of a magnetic disk 110, and the front face of a magnetic disk 110 which carries out high-speed rotation. When static electricity occurs, this static electricity is the electric conduction pattern 32 (when adhesives 33 are conductive things) from tooth-back 11c of the magnetic-head slider 11. Through the electric conduction pattern 32 and adhesives 33, it flows to gimbal section 12Aa, and flows further to the case 140 with which the magnetic disk drive was grounded through the drive arm 131. Thereby, it is avoidable that the magnetic-head component 14 of the magnetic-head slider 11 is destroyed by the effect of static electricity. In addition, since static electricity contributes to the operation to which these adhesives 33 also flow from tooth-back 11c of the

magnetic-head slider 11 to gimbal section 12Aa as mentioned above when a conductive thing is used as adhesives 33, it is more suitable.

[0045] Thus, according to the magnetic-head equipment of the gestalt of this operation, the electric conduction pattern 32 which connects the top face of Spacers 31a-31e and the front face of gimbal section 12Aa in which the magnetic-head slider 11 is laid is formed. Since it is considered as the structure which lays the magnetic-head slider 11 on insulating spacer 31a - 31e, and fixes through this electric conduction pattern 32 it can prevent certainly that the road-hugging of the magnetic-head slider 11 becomes good, and the magnetic-head component 14 of the magnetic-head slider 11 is destroyed under the effect of static electricity compared with the case where the magnetic-head slider 11 and gimbal section 12Aa are connected, only by electroconductive glue. Moreover, only by pasting up the magnetic-head slider 11 on gimbal section 12Aa, since the magnetic-head slider 11 is connected to touch-down, another process of forming the ground connection section in the periphery section of the magnetic-head slider 11 after adhesion becomes unnecessary.

[0046] Moreover, even if it uses the non-conductive adhesives which do not contain a conductive bulking agent at all, and electroconductive glue with low (that is, electric resistance is comparatively large) conductivity with few contents of a conductive bulking agent as adhesives 33 by existence of the electric conduction pattern 32, sufficient ground impact effect is acquired. For this reason, the problem of degradation of the endurance by the fall of adhesive strength does not arise. That is, it becomes possible to attain effective electrostatic-discharge prevention, securing sufficient bond strength.

[0047] The [manufacture approach of the head equipment concerning the gestalt of operation of this invention], next the manufacture approach of the head equipment concerning the gestalt of this operation are explained. In addition, since it is embodied by the manufacture approach of the head equipment concerning the gestalt of this operation, it combines below and the manufacture approach of the head slider base material concerning the gestalt of this operation is explained.

[0048] By the manufacture approach of the magnetic-head equipment concerning the gestalt of this operation, first, according to the thin film process which used the photolithography technique, after forming the magnetic-head component 14 containing the induction type MAG sensing element for writing, and the magnetic resistance element for read-out, the magnetic-head slider 11 is formed on the base which consists of ARUTIKKU (aluminum 2O3 and TiC), through the polish process of an air bearing side, the component division process by machining, etc. In addition, it may consider as a protective coat and DLC may be formed in air bearing side 11b.

[0049] Next, insulating pattern 31f and Spacers 31a-31e which consist of polyimide etc. are formed in the disk opposed face in FUREKU shear 12A of a suspension 12 by print processes, the sheet sticking method, etc. at coincidence. Spacers 31a-31e and insulating pattern 31f thickness is set to about 10-20 micrometers as mentioned above, for example.

[0050] next, liquid phase grown methods, such as vapor growth, such as sputtering and vacuum deposition, or the electrolysis galvanizing method, — an insulating pattern 31f top — the lead patterns 16a-16d and a bonding pad 17 — a-17d is formed alternatively. The electric conduction pattern 32 is alternatively formed in the predetermined field which can come, simultaneously is applied to the front face of gimbal section 12Aa through the side face from the top face of Spacers 31a-31e. The electric conduction pattern 32 is formed at the same process using the same ingredient as the lead patterns 16a-16d and bonding pads 17a-17d. For example, as described above, it considers as the two-layer structure of copper and gold, and the thickness is set to 2-3 micrometers.

[0051] Next, the isotropic electric conduction resin system adhesives of for example, an ultraviolet curing mold are alternatively applied to the field surrounded by the spacers 31a-31e on gimbal section 12Aa by for example, the micro dispenser, print processes, etc. However, as described above, non-conducting [isotropic] current resin system adhesives may be used. In addition, adhesives 33 may be applied to the magnetic-head slider 11 side, and you may make it apply them to the both sides by the side of the magnetic-head slider 11 and gimbal section 12Aa.

[0052] Next, adhesives 33 are stiffened by positioning and laying the magnetic-head slider 11 on gimbal section 12Aa of FUREKU shear 12A, and heating at predetermined temperature, while irradiating ultraviolet rays to adhesives 33, where a predetermined load (for example, about 2.0 kgf/cm<sup>2</sup>) is applied to the magnetic-head slider 11 after that. Thereby, while the magnetic-head slider 11 is fixed to gimbal section 12Aa, between tooth-back 11c of the magnetic-head slider 11 and gimbal section 12Aa(s) is connected electrically certainly.

[0053] Next, the bonding pads 15a-15d by the side of the magnetic-head slider 11 and the bonding pads 17a-17d by the side of FUREKU shear 12A are connected by the bonding using the golden ball 21.

[0054] In addition, after this, if needed, in order to protect the ball bonding section, ultraviolet-rays hardening resin (UV resin) is applied, and you may make it make it harden by UV irradiation and heat-treatment.

[0055] Thus, according to the manufacture approach of the magnetic-head equipment concerning the gestalt of this operation After forming the electric conduction pattern 32 which connects the top face of Spacers 31a-31e, and the front face of gimbal section 12Aa Since the magnetic-head slider 11 is pasted up on gimbal section 12Aa of FUREKU shear 12A and it was made to fix with adhesives 33 that in which adhesives 33 have conductivity \*\*\*\*\* — irrespective of — ground connection of the tooth-back 11c of the magnetic-head slider 11 can be certainly carried out through the electric conduction pattern 32 and FUREKU shear 12A. For this reason, it is possible to prevent effectively the electrostatic discharge of the magnetic-head component 14 at the time of use.

[0056] Moreover, according to the gestalt of this operation, even if it uses the non-conductive adhesives which do not contain a conductive bulking agent at all, and electroconductive glue with low (that is, electric resistance is comparatively large) conductivity with few contents of a conductive bulking agent as adhesives 33 by existence of the electric conduction pattern 32, sufficient ground impact effect is acquired. For this reason, the viscosity as adhesives does not become large but spreading nature is good. That is, effective electrostatic-discharge prevention can be attained, maintaining good workability.

[0057] Moreover, with the gestalt of this operation, since it was made to perform formation of the insulating spacers 31a-31e with which the magnetic-head slider 11 is laid using the same ingredient in the same process as formation of insulating pattern 31f, a production process is simplified.

[0058] Furthermore, in the gestalt of this operation, since it was made to perform formation of the electric conduction pattern 32 using the same ingredient in the same process as formation of the lead patterns 16a-16d and bonding pads 17a-17d, a production process is simplified also at this point.

[0059] Moreover, since he is trying to fix the magnetic-head slider 11 to gimbal section 12Aa with adhesives, when what was beforehand formed in the shape of a film like the conventional anisotropy electric conduction sheet is used, an adhesion process can be managed with the gestalt of this operation at once as mentioned above to two steps of adhesion processes, temporary adhesion and this adhesion, having been required for. Therefore, lead time can be shortened even if it compares, when an anisotropy electric conduction sheet is used.

Furthermore, unlike the former, reservation of the flow between both head slider, and both [ adhesion and ] is realizable with one process.

[0060] Although the gestalt of operation was mentioned above and this invention was explained, this invention is not limited to the gestalt of the above-mentioned implementation, and is variously deformable. For example, in the gestalt of the above-mentioned implementation, the insulating spacer which the magnetic-head slider 11 is laid and supports this is not limited to the spacers 31a-31e of a flat-surface configuration pattern as shown in drawing 3 , but may have other flat-surface configuration patterns.

[0061] Moreover, in drawing 3 , the electric conduction pattern 32 is really which does not have a notching hole (opening) over the whole formed as an object, and although adhesives 33 considered as a configuration which contacts only the electric conduction pattern 32 by which adhesion formation was carried out on the front face of gimbal section 12Aa, this invention is not

limited to this. For example, 1 or two or more opening patterns are prepared in the electric conduction pattern 32, and you may make it adhesives 33 contact it directly on the front face of gimbal section 12Aa through this opening pattern. In this case, even if the adhesion force of the front face of gimbal section 12Aa and the electric conduction pattern 32 is not so large, the fixing force of the magnetic-head slider 11 and gimbal section 12Aa is securable. Moreover, you may make it divide the electric conduction pattern 32 into two or more parts.

[0062] Moreover, with the gestalt of this operation, although considered as the structure containing FUREKU shear 12A which has gimbal section 12Aa, and the load beam 12, a suspension 12 can apply this invention, not only this but when the suspension of other structures is used.

[0063] Moreover, although the gestalt of this operation explained the case where head equipment was magnetic-head equipment, it is applicable also to optical head equipment, other record regenerative apparatus, for example, optical magnetic-head equipment.

[0064]

[Effect of the Invention] As explained above, a head slider base material given in any 1 of claim 1 thru/or claims 16, The manufacture approach of a head slider base material given in any 1 of head equipment given in any 1 of claim 17 thru/or claims 35, claim 36, or claims 39, Or according to the manufacture approach of head equipment given in any 1 of claim 40 thru/or claims 43 Since the electric conduction pattern for maintaining a head slider at touch-down potential was formed on the slider supporter material as a base material which supports a head slider, a head slider comes to be automatically connected to touch-down in the phase which it fixed on slider supporter material. Therefore, it is not necessary to perform touch-down separately from the loading activity of the head slider to a head slider base material. Therefore, the effectiveness that the ground connection of a head slider becomes possible is done so, simplifying manufacture.

[0065] According to the manufacture approach of a head slider base material according to claim 8, head equipment according to claim 24, and a head slider base material according to claim 37, or the manufacture approach of head equipment according to claim 41, especially Furthermore, while forming an insulating spacer on the front face of slider supporter material Since the electric conduction pattern was formed so that the field of slider supporter material which maintains a front face at touch-down potential at least, and is applied to the front face of slider supporter material from the top face of a spacer might be covered continuously While the space for adhesives restoration is enough secured by the spacer, in spite of carrying out installation immobilization of the head slider on a spacer, between the front face of slider supporter material and head sliders comes to be electrically connected by the electric conduction pattern. that is, the effectiveness that are concerned, there is nothing to the description (conductivity) of the adhesives with which the above-mentioned space for adhesives restoration is filled up, and the ground connection of a head slider becomes possible is done so.

[0066] Moreover, since the electric conduction pattern was formed according to the same ingredient and same process as a circuit pattern for transmitting the I/O signal over a head component according to claim 2 or a head slider base material given in nine, claim 18 or head equipment given in 25, the manufacture approach of a head slider base material according to claim 39, or the manufacture approach of head equipment according to claim 43, a production process is simplified.

[0067] Moreover, since the spacer was formed according to the same ingredient and same process as the insulating pattern prepared in order to insulate a circuit pattern from slider supporter material according to the manufacture approach of a head slider base material according to claim 13, head equipment according to claim 32, and a head slider base material according to claim 38, or the manufacture approach of head equipment according to claim 42, a production process is simplified more.

**\* NOTICES \***

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2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] It is a perspective view showing the appearance configuration of the magnetic-head equipment concerning the gestalt of 1 operation of this invention.

[Drawing 2] It is drawing showing the cross-section configuration of the direction of an II-II line view of drawing 1 .

[Drawing 3] It is drawing showing the flat-surface configuration of the magnetic-head equipment shown in drawing 1 .

[Drawing 4] It is drawing showing the cross-section configuration of the direction of an IV-IV line view of drawing 3 .

[Drawing 5] It is a perspective view showing the appearance configuration of the magnetic disk drive with which the head equipment concerning the gestalt of 1 operation of this invention is applied.

[Description of Notations]

10 -- Magnetic-head equipment, 11 -- A magnetic-head slider, 11a -- Component forming face, 11b -- An air bearing side, 11c -- A tooth back, 12 -- Suspension, 12A -- A FUREKU shear, 12Aa -- The gimbal section, 12B -- Load beam, 14 [ -- A bonding pad, 31a-31e / -- A spacer, 31f / -- An insulating pattern, 32 / -- An electric conduction pattern, 33 / -- Adhesives, 110 / -- Magnetic disk. ] -- A magnetic-head component, 15a-15d -- A bonding pad, 16a-16d -- A lead pattern, 17a-17d

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[Translation done.]



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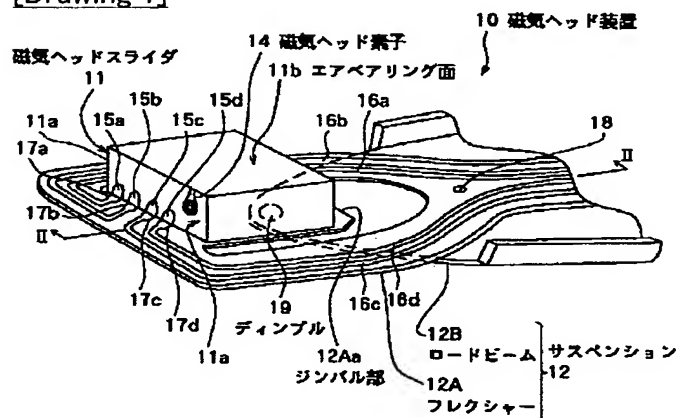
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2.\*\*\*\* shows the word which can not be translated.

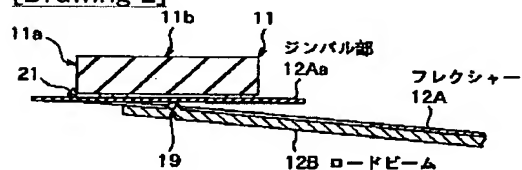
3.In the drawings, any words are not translated.

## DRAWINGS

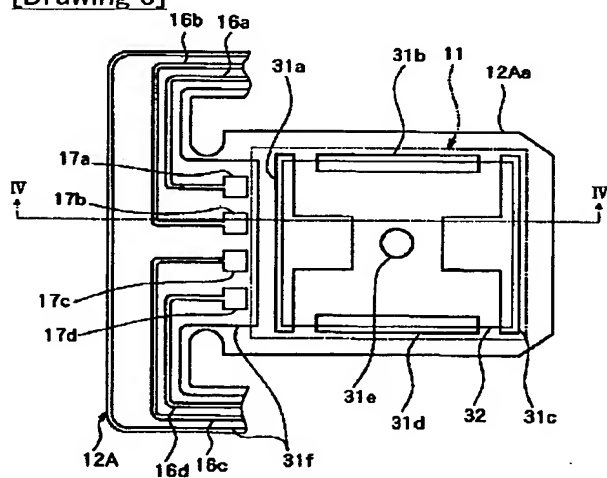
[Drawing 1]



[Drawing 2]

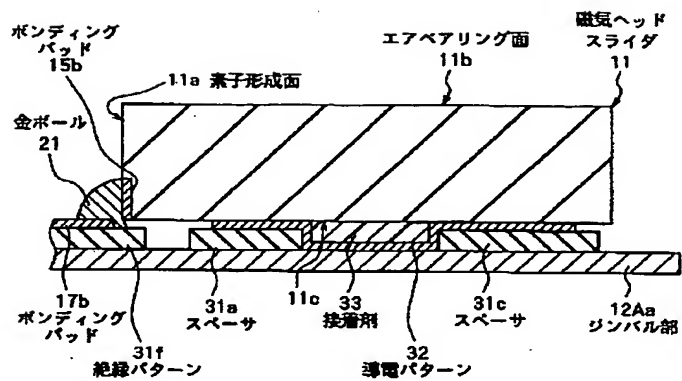


[Drawing 3]

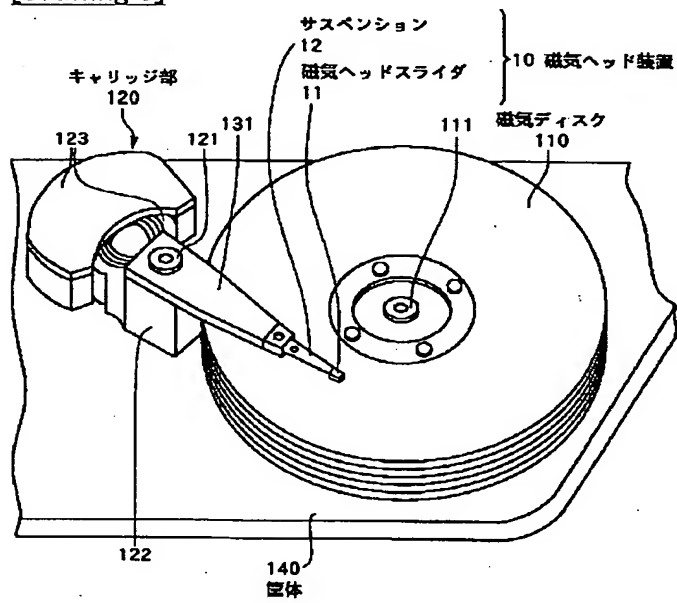


[Drawing 4]





[Drawing 5]



[Translation done.]

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